AMSAT SATELLITE REPORT

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UoSAT Progress Report

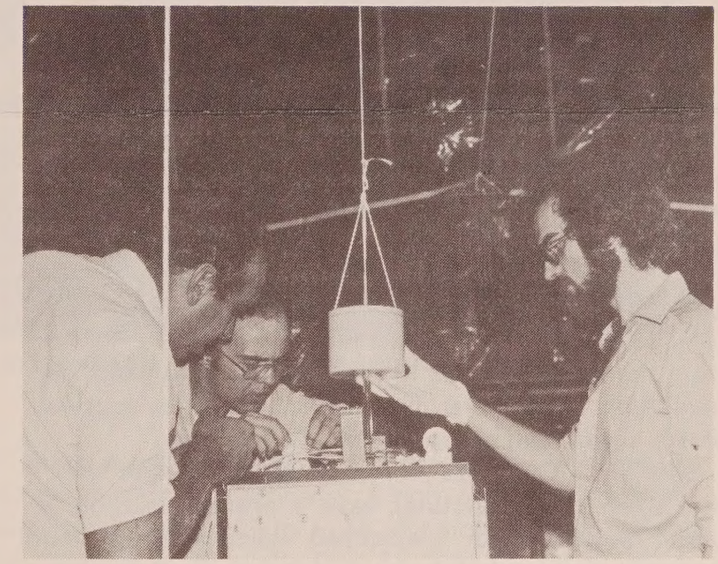
The team at Surrey seems to be making excellent progress now in the engineering phases of the early UoSAT-OSCAR 9 life. Recent reports indicated that the computer program designed to dampen the satellite's motion were complete and would be uploaded to the spacecraft computer momentarily. When employed, the program will evaluate sensor inputs such as the solar array current and make a real-time determination of the spacecraft's attitude. Then, by momentarily energizing the torquing coils, the computer will begin to orient UO-9 to the desired attitude and spin rate. The magnetic field of the torquing coils interacts with the geomagnetic field to produce a torque on the frame of the spacecraft and thus an acceleration. In the case at hand the acceleration is negative and will in fact be nulling the precession and nutuation moments. When the undesired motions have been dampened to a predetermined point, the gravity gradient boom will be deployed in short increments. The tip mass (a 2 kg mass) will further stabilize the spacecraft and provide the stability necessary for the precision magnetometer experiment. At full extension the boom is 50 feet long.

UoSAT officials also reported the first test of the CCD camera was positive. No earth images were attempted (the satellite is not oriented correctly for that) but a test pattern from the electronics package associated with the camera was received perfectly at the Surrey command station.

Future phases of testing will include both low and high speed cw telemetry as well as 45.5 baud RTTY. Despite rumors to the effect that UO-9's 70 cm beacon has been heard, G3AAJ says that it has not been activated. The engineering phase of UO-9's early days are likely to be complete in the next month or less and users may expect the full complement of experiments to be activated when Surrey officials are satisfied all's well with the Amateur World's first Amateur Research Satellite.

Oooops!

From our "What's in a Name Department" this: W3CQB is pictured on page 4 of *ASR* #19. Be assured Charlie is "Strong" and not "Strange" as we typoed. Sorry Charlie! Only the best OM get to have their names botched by us. Oh well!



L to R: LU9HBG, Mario Acuna; G3YJO, Martin Sweeting; G6BTU, Ian Ferebee. Here at the Magnetic Test Facility at the Goddard Space Flight Center the team is seen making repairs to a crimped cable. (27 Aug. 81) Ian is seen supporting the boomer tip mass which has been deployed about 10" to allow the repairs to proceed.

UoSAT Orbit Update

The following data may be employed with the W3IWI orbital program. These data are for UoSAT-OSCAR 9 and come from NASA bulletin number 31 for object 1981-100B (UO-9).

Reference Epoch: 81-320.06953538
Inclin: 97.4594
RAAN: 281.5330
Eccentricity: 0.0005647
Argument of Perigee: 135.5905
Mean Anomaly: 224.577
Mean Motion: 15.10968816
Mean Motion (second order term): 0.00021797

The modifications to the W3IWI program (which appeared in *ORBIT* Magazine #6) to allow incorporation of the second order mean motion term will be published in the next issue of *ASR*. The patch is not extensive involving only a half dozen lines of code or so.

Reference Orbit for 2 Dec. 81:
Orbit No. 854 00:37:22 143.06
Weekly averages: 25 Nov.-2 Dec. Mean Period: 95.32911
Mean Incr: 23.8329

What Is SME?(UO-9's Launch Partner)

Little has been said of the Solar Mesosphere Explorer (SME) which was the primary payload launched on Sept. 15, along with UoSAT-OSCAR 9. SME was designed and built in Boulder, Colorado, where the University of Colorado acts as primary ground command station. SME is an atmospheric research satellite designed to study the reactions which occur between sunlight, ozone, and other components of the upper atmosphere in the 30 to 90 km region. In the mesosphere, short wavelength radiation energizes a number of photochemical reactions of which the creation of a layer of ozone is the most notable. This layer effectively absorbs most of the Sun's ultraviolet radiation entering the atmosphere. SME carries five instruments to monitor the concentration of ozone and other compounds. It also measures the amount of solar radiation, water vapor, and ambient temperature along its orbital path.

Instrumentation includes spectrometers sensitive to specific wavelengths corresponding to the presence of ozone, hydroxyl groups, and nitrogen dioxide. A 4-channel radiometer will record temperature and pressure while a solar UV monitor will measure incoming solar radiation. As the satellite spins, four of the five instruments will be gated open once each revolution to gather data as their fields of view sweep Earthward. The solar monitor is active all the time but its sensor is tilted from the rotational axis to scan the Sun only once per revolution. A 2.2 meter disc-shaped solar array supplies SME's power, and charges the Ni-Cd batteries.

SME and UO-9 share more than their common "ride" into space. Both satellites have a primary mission of basic research with specialized instrumentation onboard to collect and forward large amounts of data. Compared to UO-9, SME is more a research tool than an educational machine. Data from SME will help develop more accurate models of ozone production and depletion on a global scale thus enhancing our knowledge about a potential problem of global significance.

UoSAT Demodulators

A number of interesting circuits for demodulating the UO-9 FSK telemetry have been designed. One design using a couple of CMOS ICs appears in the UoSAT Technical Handbook. A circuit using a type 555 timer and some elementary CMOS chips was sent in by KE5O, Steve Gomez of Beaumont, Texas. Perhaps the most sophisticated circuit to be submitted comes from W6HDO, Cliff Buttschard of San Luis Obispo, California. Cliff's circuit uses a special purpose modem-on-a-chip circuit. The modem is the EXAR (or Raytheon) 2211. It is supported by a single TTL IC (7402). If RS-232 levels are required a plus and minus 12 volt supply must be added. Otherwise Cliff's circuit will work from a single 5 volt supply.

Cliff also designed a passive LC filter to change the audio output frequency response from your FM receiver. The filter is placed in series with the receiver's speaker to tailor the response to what is needed for data demodulation of the 1200 and 2400 Hz tones. The usual receiver power amplifier is designed to optimize voice frequency response. Because of the significant interest expressed by AMSAT members in a demodulator for UO-9, copies of W6HDO's circuit will be made available to *ASR* subscribers for a #10 SASE to WA2LQQ, P.O. Box 177, Warwick, NY 10990. The circuit diagram will appear also in a future issue of *ORBIT*. If demand requires, a kit of parts for the circuit may be made available for both the demodulator and the passive filter.

Recent Large Donations

The donation of $10,000 to the AMSAT coffers by Jordan's King Hussein, JY1, was reported in ASR #20. Now comes word of several additional large donations. A donor, who wishes to remain anonymous, has pledged $5,000 to AMSAT. Additionally, the Radio Club of America has donated $500 and The Atlanta Radio Club has donated $350. AMSAT sincerely thanks these thoughtful supporters for their generosity.

UoSAT OSCAR 9 Tracking Overlays

QST, the ARRL journal, will print artwork suitable for tracing onto acetate in the December issue now being mailed. The resultant overlays may be used with the new ARRL locator package to track UO-9. The locator package is available from AMSAT, P.O. Box 27, Washington, DC 20044 for $7.00 plus $1.00 postage. (Check, Money Order or Master Charge/Visa)

Board Meeting Summary

The AMSAT Board of Directors met for its semiannual meeting on 18 Oct. 81 at the Goddard Space Flight Center. The following is a summary of the major activities.

The Board acted to:

1) Name the incumbent Officers for the 81/82 year, specifically

W6SP, Chairman of the Board
N3CHZ, Secretary to the Board
W3IWI, President
WA2LQQ, Executive Vice President
K1HTV, Operations Vice President
W3GEY, Engineering Vice President
K9LF, Special Projects Vice President
Martha Saragovitz, Corporate Secretary
K4YV, Treasurer

2) Upgrade the membership participation by better cataloging skills and matching them to tasks.

3) Award Honorary Life Memberships to W4PUJ, G3YJO, LU9HBG, W9IQO, HA5WH.

4) Commend W4MID, WD4FAB, VE3HCR, ZS1BI, W1XT, W6CG, WØCY, WA2LQQ, W8GQW, KEØT and PAØDLO, KL7GRF, W4OWA, WA6VGS, WDØEEK, W3OZ, and Fred Mobley.

5) Increase President's signatory authority to $2500.

6) Congratulate the University of Surrey team on the successful launch of UoSAT-OSCAR 9.

7) Thank HAL Communications for the loan of a CT-2100 terminal used at the AMSAT Lab at Goddard for copying the UO-9 telemetry.

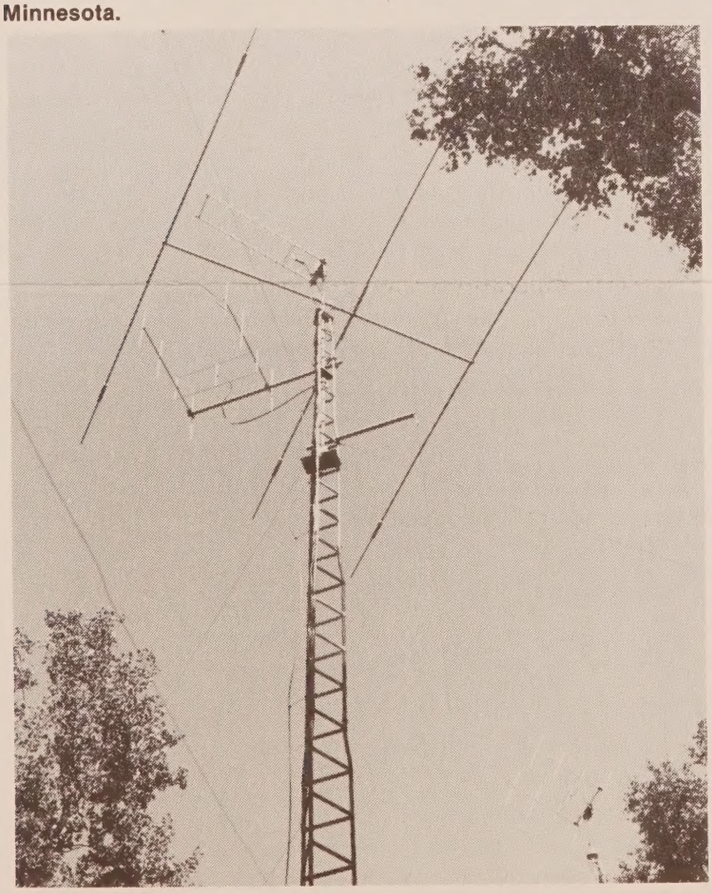
ASR *Spotlight On: WØCA*

Pioneers in many fields know a special thrill that the rest of us mortals miss. Their's alone is the satisfaction of knowing that none has set foot "here" before. We suspect that many pioneers in science and technology are driven by the same desire to be first as are the classic explorers; those odd chaps search for the Source of the Nile or a short route to India.

Such a pioneer is our subject here. Having been a ham since 1929, Nick Laub, WØCA, was literally astounded to recognize some three years ago that he was within reach of a feat that had never before been accomplished: Worked All Continents (WAC) on OSCAR. The revelation of where he stood in relation to this "never-neverland" of amateur satellites came while reflecting upon his QSO with UAØBBN. With the Asian continent done, he realized, the hardest one was behind. He had already chalked up CN8AK (Africa), KH6IBA (Oceania), G3IOR (Europe) and KØGA (North America). That left just South America to garner. Finally it was done. HC1BI, Beni from Quito, provided Nick with the impossible. A satellite WAC! Nick says he considers this the most significant event in his half century of hamming.

Nick's interest in Amateur Radio began in Chicago in 1929 and he obtained the call W9HXM. He has been involved in radio both professionally and avocationally since. He was a factory representative for some of the most famous names in Amateur equipment for more than 20 years. During WWII he was with the Signal Corp of course. As a member of a special elite civilian team he was sent to France to help build the BC 645 (walkie-talkie) in that country.

Some of the antenna farm at the WØCA summer home in Northern Minnesota.



WØCA with his homebrew 9 turn helix for 70 cm.

More recently Nick has become heavily involved in Amateur Satellite activities which he considers "the most stimulating activity in all of Amateur Radio." Having "tried everything else from SSTV to RTTY," he found OSCAR to be the only activity to give "a continuous thrill" and excitement. "It just never gets dull," Nick exclaims jubilantly.

His enthusiasm for OSCAR-chasing extends to the classroom where he is a frequently invited guest having given innumerable talks on the subject from Tampa to Venice (both Florida). Because he's been active since the OSCAR 4 days, too, there are not too many aspects of the subject that Nick does not address with authority. In addition to schools, Nick is a welcome guest speaker at many Florida club meetings and conventions. This is the third year running that he will speak on satellites to the Sarasota Hamfest.

The interesting thing that WØCA has in common with many other famous explorers and adventurers is that he doesn't collect trophies. Although he has worked more than 300 countries, he doesn't have a DXCC. "I'm just not an award chaser," he says. The WAC plaque he received from ARRL (see *ORBIT* #5, page 29) is the exception. "I just enjoy knowing I've done 'it' and that's all," Nick modestly adds.

And so it would seem with all men of great character; the more they do, the less they seek a brass band to announce the fact to the world. *ASR* and AMSAT salute a modern "hero" and adventurer in the classic sense. Well Done! 73 from those who wish they could have been first!

SAT TRACK International

A number of individuals have inquired about the address of the SAT TRACK International mentioned by KA9Q in his *ORBIT* article in the Nov./Dec. 80 issue (page 31). Phil advises that SAT TRACK International can be reached at the following address:

Computerland Store
4543 Templeton Gap Road
Colorado Springs, CO 80909

Area Coordinator Actions

Several additional Chief Area Coordinators have been named (See *ASR* #20). Recent additions include: WH6AMX, Rick Dittmer, Pacific; JA1ANG, Harry Yoneda, Asia; G3IOR, Pat Gowen, Europe. Congratulations and thanks to all. Addditional Chief Area Coordinator appointments are pending according to Operations VP K1HTV.

More Details on UoSAT

CCD Camera Imaging Experiment: (Dr. Paul Traynar, UOS-AMSAT, UK)

A two dimensional, charge-coupled device imaging array (GEC MA357) is mounted in the bottom (−z) of the s/c central column which, using the gravity gradient stabilisation mechanism, should point towards the centre of the earth and provide images of land, sea and cloud cover over a 500 x 500 km area of the earth's surface. The image is formed by integrating the amount of light falling on the 65,536 (organised as 256 x 256) light sensitive 'buckets' of the array over a set period of time and then transferring the resulting accumulated charge into a similar, masked storage area alongside. The integration time of the CCD is under ground control via the command system and can be set to any of 16 preset periods between 4 mS and 16 mS. The spectral response of the CCD is in the visible/red range and should give good haze penetration. The charge 'image' in the CCD storage area is then digitised into 4-bit words (each word representing a pixel), and transferred once more to a long-term memory in the Video Display Experiment module. The data now resident in the VDE memory can be transmitted to ground stations at 1200 bps (phase-synchronous a.f.s.k.) through the General or Engineering Data Beacons. The image data is transmitted in a line synchronous manner, i.e., 256 x 4 bits are sent (representing one line of image) in one continuous stream preceded by a 'line sync' bit pattern comprising an 32-bit code sequence. The 32-bit code itself comprises an 8-bit word and its one's complement repeated twice.

The complete image dump will take approximately 3.5 minutes from the s/c and comprises:

A frame header comprising one line of 16 line sync codes.

256 lines of 1024 bits (organised as 256 x 4 bits) each preceded by a line sync. code

The 'line sync' code format is:

0101101110100100 0101101110100100 =5 BA4

The primary s/c computer has direct access to the VDE memory and it may be possible to carry out on-board image processing and annotation.

Lens characteristics:
- focal length: 6.5 mm
- speed: 1:1.8
- aperture: 1.5 mm f/4
- neutral density filter: 1/32

Field of view: 60 degrees
CCD intensity dynamic range: 35dB
CCD vertical transfer clock rate: 6.6 MHz 3-phase
CCD frame transfer clock rate: 2 MHz
Power consumption: Imaging - 1.5 watts (for 1 second)
Store/readout - 2.8 watts continuous

H.F. Beacons Experiment: (Colin Smithers G4CWH, UOS-AMSAT, UK)

Phase-related beacons on 7.050 MHz, 14.002 MHz, 21.002 MHz and 29.510 MHz will support a wide range of ionospheric experiments and observations. The four beacons are each derived from their own crystal oscillator and can be operated independantly, however a synthesiser network enables the 14,21 & 29 MHz oscillators to be phase-related to the 7 MHz oscillator thus maintaining constant phase relationship between all the beacons for trans-ionospheric path analysis. The synthesisers can be turned off allowing the beacons to free-run. The beacons can be modulated (on/off a.m. keying) with morse code telemetry interspersed with a carrier or a continuous carrier upon ground command. The output power of the beacons is 100 mW each with a total experiment power consumption of 1.2 watts dc. The 50 foot stabilisation boom will be excited by the h.f. dipole antennas and should result in a strong radiated signal even at the lower frequencies.

Magnetometer Experiment: (Dr. Mario Acunia, AMSAT-USA)

A three-axis, multi-range, fluxgate magnetometer will allow the detection and monitoring of geomagnetic storms and their possible effects on radio propagation as well as the study and mapping of the main geomagnetic field, thus providing amateurs with advanced diagnostic and study capabilities.

Special emphasis will be placed on the acquisition of real-time and stored data over the polar regions.

The basic dynamic range of the magnetometer instrument is ±8000 nT and the output is digitised by a 12-bit A/D converter. Since the strength of the geomagnetic field is approx. 30,000 nT at the equator and 60,000 nT at the poles, the basic range of the magnetometer is increased to 64,000 nT by biasing the zero level in 16 steps.

Dynamic range: ±8,000 nT
Resolution: ±2 nT
Zero level stability
- sensor (−60°C to +60°C): ±5 nT
- electronics (−20°C to +50°C): ±2 nT

Linearity errors: < 2 x 10*5
Bias Field Generator
- dynamic range: ±64,000 nT
- quantisation step: 8,000 nT
- temp. coeffnt: 2 ppm/°C

Power consumption: 500 mW

Two outputs are presented for each axis - 'coarse' & 'fine' - and the full resolution data are available to the primary s/c computer, while quick-look data are reduced to 10 bit resolution and presented to the analogue telemetry system with a resulting max. resolution of ±8 nT.

Speech Synthesiser Experiment: (UOS-AMSAT)

A 120-word speech synthesiser based on the National Semiconductor "Digitalker" integrated circuit is under the control of the primary on-board computer via a high speed 14-bit parallel port. Thus telemetry, s/c status and programs, orbit ephemeris data and general s/c news can be encoded in 'English' and relayed via the general, engineering or 2.4 GHz beacons using n.b.f.m.

Power consumption: 2.5 watts (when speaking)
0.25 watts (standby)

SHF Beacon Experiment: Richard Porter, Microwave Modules, UK)

A beacon on 2401 MHz will transmit the same data source provided to the VHF General Data Beacon on n.b.f.m.

Power o/p: 125 mW
dc i/p: 2.9 watts
modulation: n.b.f.m. ±10 kHz
max. doppler: ±51.3 kHz
path loss o/h: −152 dB
horiz: −169 dB

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